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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
HAN, SHENG	

ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
11/12/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/523,070	YAGI ET AL.	
	Examiner	Art Unit	
	SHENG HAN	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 September 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 -5, 7, 8, 18, 30-35, 53, 54, 57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 -5, 7, 8, 18, 30-35, 53, 54, 57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/4/09 has been entered.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claim 18 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent Application Number 10/589853 in view of Takeyama (JP 2003/340273).

Claim 1 of 853' overlap Claim 18 of this Application except that it does not teach use of an insulating layer that is heated with electrodes exposed on one end.

Takeyama teaches a chemical reaction apparatus within a thin film heater is used in a microreactor apparatus and a protective film covering heater wiring is flattened to it (abstract). Flow passages pass on the surface of a main substrate where a laminated film is formed on the back of the substrate as a protective film in order to hold a constant temperature of the heater to the substrate.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a protective layer between the heater and substrate layer, as taught by Takeyama with the apparatus as claimed in Claim 1 of 853' because insulating layers prevent hot spots, more evenly distribute the heat across the substrate and retains more heat into the system.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 7, 8, 18, 30, 53, 54 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koripella (7048897) and further in view of Takeyama (JP 2003/340273).

As to Claims 1, 7, 8, 18, 30, 53, 54 and 57, Koripella teaches a hydrogen generator that is used for fuel reforming (abstract) that is used for small portable units (col. 1, lines 32-33) and the miniaturization of the reformer (col. 2, line 14). The reformer includes a vaporization zone and a reaction zone with a catalyst (abstract). There is an inlet channel and an outlet channel (abstract). The system comprises a

heating source (Fig. 1, 28 and col. 3, line 42), which could be an electrical heater (col. 3, lines 60-61). Serpentine channels are incorporated on the other end of a substrate (col. 6, lines 46, 49-50). Catalysts sit in the channel walls of the channels (col. 6, lines 54-56). Although Koripella teaches use of thermal insulators 1, 70 and col. 5, line 31), Korpella does not specifically teach that there is a thermally insulating layer between the heater and the substrate with the serpentine channels.

Takeyama teaches a chemical reaction apparatus within a thin film heater is used in a microreactor apparatus and a protective film covering heater wiring is flattened to it (abstract). Flow passages pass on the surface of a main substrate where a laminated film is formed on the back of the substrate as a protective film in order to hold a constant temperature of the heater to the substrate.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a film or insulating member between the heater and the substrate, as taught by Takeyama with the microreactor as taught by Koripella because it prevents formation of hotspots in the microchannel itself, retains more heat in the system, and provides greater uniformity in heat distribution.

Takeyama teaches that the electrodes are exposed on the sides. Although neither reference teaches that the electrodes are exposed on the back surface, it would have been obvious to one of ordinary skill in the art at the time of the invention that some of the heating element could be exposed since the purpose of the insulating film is merely to better distribute heat to the substrate.

since both Koripell and Takeyama uses microchannels, it would have been obvious to one of ordinary skill in the art at the time of the invention that they cells should be encased in a housing to prevent fuel from leaking out of the system and directed to the proper channels for fuel reform. It also prevents H2 from escaping into the atmosphere once it is generated.

As to the additional features in Claim 18 regarding the joined cover to the microchannel feature, it is obvious to have a cover over the microchannels so as to keep fuel and H2 gas from escaping the system. Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the housing or cover used over the microchannel could be attached so that it does not become removed or fall off during normal use.

As to the additional features of Claim 30 regarding joining the cover to the microchannel substrate, it would have been obvious to one of ordinary skill in the art at the time of the invention that the cover would be joined to the microchannels so that it does not become removed or fall off during normal use.

Claims 2, 3, 5, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koripell and Takeyama as applied to claims 1 and 30 above, and further in view of Taketetsuo (JP 2001/302203).

As to Claims 2, 3 and 5, Koripell and Takeyama teach that the substrate that has microchannels can be a ceramic composition (Koripell, col. 6, line 29). They also teach use of a catalyst in their system that can be copper oxide or another metal oxide (col. 7, lines 11-12). Neither of them teaches that the microreactor substrate is Al, Cu or stainless steel.

Taketetsuo teaches a process for reforming fuel comprising a catalyst layer and an alumina layer where the alumina layer is made by anodizing the surface of the alumina substrate (abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a known metal substrate for use in a reformer, such as Al or Cu, as taught by Taketetsuo, with the reformer as taught by Koripell and Takeyama because it is a known metal for use in as a substrate for fuel reforming.

Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Korpell and Takeyama as applied to claim 1 above, and further in view of Thies (6736983).

As to Claims 2, 3 and 31, Korpell and Takeyama teach a microreactor with microchannels that can be made of a ceramic composition. The device is used for reforming fuel and has a catalyst layer in the channel walls. The device also has a heater with an insulating layer between the heater and the substrate. Neither references teach that the substrate is Cu, Al or stainless steel, nor do they teach that the insulating film is a metal oxide formed by anodically oxidizing the metal substrate.

Thies teaches a microreactor for obtaining hydrogen gas (col. 1, line 8) characterized by comprising a metal substrate (col. 2, lines 5-6, steel plates, col. 3, line 7 and col. 3, lines 20-22 metal substrate layers) and having a microchannel portion on one surface thereon (Fig. 1, b, b', c and c'). The reference discloses that a catalyst can be placed on the microchannel portion of the substrate (col. 7, line 12 and col. 7, line 24). Thies discloses a cover member (Fig. 4, a, c, layer 2 and col. 6, line 46-49). Furthermore, Thies teaches that steel, copper or aluminum can be used as a substrate (metal layer, col. 6, line 21 or col. 6, line 21 or 37). Thies also teaches the formation of a metal oxide layer by anodically oxidizing the metal substrate (col. 7, lines 18-20, where the substrate is aluminum and the aluminum is oxidized with an acid).

It would have been obvious to one of ordinary skill in the art at the time of the invention to oxidize the substrate, as taught by Thies, with the microcreator, as taught by Korpell and Takeyama because oxide layers can carry catalysts and facilitate a composition's reaction with such catalyst.

Regarding Claim 3, Korpell teaches use of a metal oxide film as the catalyst layer within the channels.

Claim 32 rejected under 35 U.S.C. 103(a) as being unpatentable over Koripella and Takeyama as applied to claim 30 above, and further in view of Lambert (5139648).

Koripella and Takeyama teach a method of reforming fuel using a microchannel substrate with a catalyst and oxide layers on. Neither of them teach that the oxide layers are formed with boehmite however.

Lambert teaches that boehmite can be used instead of alumina (para. 0081). Boehmite is aluminum oxide hydroxide, or AlO(OH). It would have been obvious to one of ordinary skill in the art at the time of the invention to use boehmite, as taught by Lambert, with the microreactor, as taught by Korippa and Takeyama because Lambert teaches that boehmite could be used instead of aluminum oxide and that they are potential substitutes of one another. It would further have been obvious to one of ordinary skill in the art at the time of the invention that the alumina would likely become further oxidized under the heated conditions of the microreactor, hydrogen gas being generated and oxygen ions, so that a hydroxyl group would be added to the oxidized alumina.

Claim 33 rejected under 35 U.S.C. 103(a) as being unpatentable over Koripella and Takeyam as applied to claim 30 above, and further in view of Kearl (6828055).

Koripella and Takeyama teach a method of reforming fuel using a microchannel substrate with a catalyst and oxide layers on. Underneath the substrate is a heater portion. Neither reference teaches that the section of the channels are u-shaped or semicircular however.

Kearl teaches a microreactor that generates hydrogen gas (col. 8, lines 5-6 and 17, catalyst can be used to accelerate the conversion of hydrocarbons and alcohols to

hydrogen), comprising a metal substrate (col. 7, lines 34-35, coated with a precious metal), having a microchannel portion on one surface thereof (Fig. 1), a heater provided on the other surface of said metal substrate (Fig. 2B, 30 and 32 anode and cathode, which generate heat Fig. 2B, 24 and 26 are under substrate and claim 11, second face adopted to contact a cathode of a second fuel cell and Claim 16, resistive element adopted to heat the substrate, Fig. 2B, 14, microchannel, 16, back of substrate col. 12, lines 17-18, Fig. 2B, 30 and 32 are electrodes that heat substrate). Between the metal substrate and the heater (electrode) is a thin film insulating layer (col. 10, line 30, resistive element that may be a thin film resistive element), a catalyst supported on said micrchannel portion (col. 9, lines 55-56, catalyst is coated in microchannels, Fig. 7, 5 and Fig.12, 50), a cover member joined to said metal substrate so as to cover said microchannel portion (Fig. 2A, microchannels layered on top of one another so that the backs of each microchannel is the cover member and Fig. 2A, 66 is another cover member). Finally, Kearl teaches an inlet and an outlet (Fig. 8, Fig. 7, 46, 50) which are both capable of supplying feed material in and gas out. Kearl does not teach forming a metal oxide film on an inner wall surface of said flow path however.

Regarding Claim 33, Kearl teaches that the microchannels are U-shaped or semi-circular (Fig. 8).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use U-shapoed or semi-circulate channels in the reformer, as taught by Kearl, with the system described by Koripella and Takeyama because it allows for

easier and more even deposition of catalysts as well as more even activation of the catalytic layers than if the channels were blocked or square shaped.

Regarding Claim 34, Kearl teaches coating the metal substrate with a catalyst using different methods such as spin coating, dip coating or dry film laminating (col.12, line 57), but does not specifically teach that the catalyst is dried in the microchannels. Bae teaches a microchannel with flow channels (para. 0005), where the slurry of catalyst is allowed to dry on the susbstrate (para. 0012, para. 0026 using the tape casting method and para. 0027).

Regarding Claim 35, Kearl teaches that catalyst can be applied using spin casting (para. 0012).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHENG HAN whose telephone number is (571)270-5823. The examiner can normally be reached on Monday-Thursday, 8:00-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Sheng Han
Examiner
Art Unit 1793

November 5, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793